

Amendments to the Claims:

This listing of claims will replace all prior versions, and listings, of claims in the application.

Listing of Claims:

1. (currently amended) A chlorine-containing gas generant

composition consisting essentially of comprising:

a nitrogen-containing fuel;

ammonium perchlorate oxidizer; and

a chlorine scavenger present in an amount effective to result in a gaseous effluent that is substantially free of hydrogen chloride when the gas generant is combusted;

wherein at least about 98 weight percent of the chlorine scavenger is a copper-containing compound selected from the group consisting of copper nitrate complexes, basic copper nitrate, cupric oxide, and combinations thereof.

2. (original) The chlorine-containing gas generant composition

of claim 1 containing no more than about 1 composition weight percent of a copper-free chlorine scavenger.

3. (original) The chlorine-containing gas generant composition of claim 1 wherein the nitrogen-containing fuel is selected from the group consisting of amine nitrates, nitramines, heterocyclic nitro compounds, and combinations thereof.

4. (original) The chlorine-containing gas generant composition of claim 1 wherein the nitrogen-containing fuel is guanidine nitrate.

Claim 5 (canceled)

6. (original) The chlorine-containing gas generant composition of claim 1 wherein the copper-containing compound is copper diammine dinitrate.

7. (original) The chlorine-containing gas generant composition of claim 1 wherein the copper-containing compound is basic copper nitrate.

8. (currently amended) The chlorine-containing gas generant composition of claim 1 including comprising:

about 1 to about 20 composition weight percent ammonium perchlorate; and

about 80 to about 99 composition weight percent of a precursor blend, wherein the precursor blend includes the nitrogen-containing fuel and the chlorine scavenger.

9. (currently amended) The chlorine-containing gas generant composition of claim 8 wherein the precursor blend includes comprises:

about 30 to about 70 composition weight percent of a nitrogen-containing fuel; and

about 30 to about 70 composition weight percent of a chlorine scavenger.

10. (currently amended) The chlorine-containing gas generant composition of claim 9 wherein the precursor blend further includes comprises up to about 10 composition weight percent of at least one metal oxide burn rate enhancing and slag formation additive.

11. (original) The chlorine-containing gas generant of claim 10 wherein the metal oxide burn rate enhancing and slag formation additive is selected from the group consisting of silicon dioxide, aluminum oxide, zinc oxide, and combinations thereof.

12. (currently amended) The chlorine-containing gas generant of claim 9 wherein the precursor blend further includes comprises up to about 10 composition weight percent of at least one compound effective to enhance combustion of ammonium perchlorate.

13. (original) The chlorine-containing gas generant of claim 12 wherein the combustion enhancer is selected from the group consisting of iron oxide, copper chromite, Iron Blue pigments, and combinations thereof.

14. (original) The chlorine-containing gas generant of claim 12 wherein the combustion enhancer is an Iron Blue pigment.

15. (currently amended) The chlorine-containing gas generant composition of claim 9 wherein the precursor blend includes comprises: guanidine nitrate fuel; and a chlorine scavenger including copper diammine dinitrate.

16. (currently amended) The chlorine-containing gas generant composition of claim 9 wherein the precursor blend includes comprises: guanidine nitrate fuel; and a chlorine scavenger including basic copper nitrate.

17. (original) A method for generating an inflation gas for inflating an airbag cushion of an inflatable restraint system of a motor vehicle comprising the steps of:

igniting the chlorine-containing gas generant composition of claim 1 to produce a quantity of inflation gas; and
inflating the airbag cushion with the inflation gas.

18. (original) The method of claim 17 wherein the inflation gas is substantially free of hydrogen chloride.

19. (original) The method of claim 17 wherein the chlorine-containing gas generant composition contains no more than about 1 composition weight percent of a copper-free chlorine scavenger.

20. (currently amended) The method of claim 17 wherein the chlorine-containing gas generant composition includes comprises:

about 1 to about 20 composition weight percent ammonium perchlorate oxidizer; and

about 80 to about 99 composition weight percent of a precursor blend; wherein the precursor blend includes the nitrogen-containing fuel and the chlorine scavenger.

21. (currently amended) A chlorine-containing gas generant composition providing an improved gaseous effluent, the chlorine-containing gas generant composition consisting essentially of comprising:

about 1 to about 20 composition weight percent ammonium perchlorate oxidizer; and

about 80 to about 99 composition weight percent of a precursor blend including:

guanidine nitrate fuel; and
a chlorine scavenger in an amount effective to result in a gaseous effluent substantially free of hydrogen chloride,
wherein at least about 98 weight percent of the chlorine scavenger is a copper-containing compound selected from the group consisting of copper nitrate complexes, basic copper nitrate, cupric oxide, and combinations thereof.

22. (original) The chlorine-containing gas generant composition of claim 21 wherein the precursor blend includes:
about 30 to about 70 composition weight percent of guanidine nitrate fuel; and
about 30 to about 70 composition weight percent of a chlorine scavenger.

23. (original) The chlorine-containing gas generant composition of claim 21 containing no more than about 1 composition weight percent of a copper-free chlorine scavenger.

24. (original) The chlorine-containing gas generant composition of claim 21 wherein the copper-containing compound is copper diammine dinitrate.

25. (original) The chlorine-containing gas generant composition of claim 21 wherein the copper-containing compound is basic copper nitrate.

26. (original) A method for generating an inflation gas for inflating an airbag cushion of an inflatable system of a motor vehicle comprising the steps of:

igniting the chlorine-containing gas generant composition of claim 21 to produce a quantity of inflation gas; and

inflating the airbag cushion with the inflation gas.

27. (currently amended) The method of claim 26 wherein the precursor blend includes comprises:

about 30 to about 70 composition weight percent guanidine nitrate fuel;
and

about 30 to 70 composition weight percent of a chlorine scavenger.

28. (original) The method of claim 26 wherein the inflation gas is substantially free of hydrogen chloride.

29. (currently amended) The method of claim 26 wherein the precursor blend additionally includes comprises a metal oxide burn rate enhancing and slag formation additive selected from the group consisting of silicon dioxide, aluminum oxide, zinc oxide and combinations thereof.

30. (currently amended) The method of claim 29 wherein the precursor blend includes comprises:

about 30 to about 60 composition weight percent guanidine nitrate;

about 30 to about 68 composition weight percent copper diammine dinitrate; and

silicon dioxide in an amount up to about 10 composition weight percent.

31. (currently amended) The method of claim 29 wherein the precursor blend includes comprises:

about 35 to about 60 composition weight percent guanidine nitrate;

about 30 to 60 composition weight percent basic copper nitrate; and

at least one metal oxide burn rate enhancing and slag formation additive
in an amount up to about 5 composition weight percent.

32. (currently amended) The method of claim 31 wherein the
precursor blend further includes comprises at least one combustion enhancer selected
from the group consisting of iron oxide, copper chromite, Iron Blue pigments, and
combinations thereof in an amount up to about 5 composition weight percent.

33. (currently amended) The method of claim 31 wherein the
precursor blend further includes comprises at least one Iron Blue pigment in an
amount of up to about 5 composition weight percent.

Amendment to the Claims

By the above,

1. independent claims 1 and 21 have each been rewritten to employ
“consisting essentially of” transition language and to require that the
copper-containing compound is selected from a specifically listed group of
compounds, with claim 5 correspondingly being canceled; and

5 2. dependent claims 8-10, 12, 15, 16, 20, 27 and 29-33 have each
been rewritten to no longer employ “comprising” transition language.

10 Claims 1-4 and 6-33 remain in the application.

Claim Rejections - 35 U.S.C. §112

1. Claims 1-4, 8-14, 17-23 and 26-33 were rejected under 35 U.S.C. §112, first
paragraph, as not being enabled by the specification.

15 In particular, the Action alleges that the specification, while being
enabling for a gas generant composition with specific copper compounds disclosed
in the specification does not reasonably provide enablement for any gas generant
composition with any copper-containing compound.

20 Further, the Action alleges that the “specific copper compound is critical
or essential to the practice of the invention, but not included in the claim(s) is not
enabled by the disclosure.”

By the above, independent claims 1 and 21 have each been rewritten to list the specific copper-containing compounds. In view thereof, the rejections of these claims for non-enablement are believed to have been overcome and/or otherwise clearly rendered inapplicable to the resulting claims and notification to that effect is solicited.

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2. Claims 1-4, 8-14, 17-23 and 26-33 were rejected under 35 U.S.C. §112, second paragraph, as being "incomplete for omitting essential elements, such omission amounting to a gap between the elements."

The Action states that the specific copper compound is the omitted element.

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By the above, independent claims 1 and 21 have each been rewritten to list the specific copper-containing compounds. In view thereof, the rejections of these claims as being incomplete are believed to have been overcome and/or otherwise clearly rendered inapplicable to the resulting claims and notification to that effect is solicited.

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3. Claims 1-33 were rejected under 35 U.S.C. §112, second paragraph, as being indefinite for allegedly failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

The Action alleges that the claims all recited a "chlorine-containing" composition but that "there is no chlorine present in the composition".

Such rejections are respectfully traversed.

Independent claims 1 and 21 each require that the respectively claimed gas generant compositions contain ammonium perchlorate oxidizer. Ammonium perchlorate contains the element chlorine. Consequently, the claimed gas generant compositions are "chlorine-containing".

In view thereof, the withdrawal of this basis of rejection and notification to that effect is requested.

The Action also alleges that the claims requiring that at least 98% of the chlorine scavenger is a copper compound is inconsistent with comprising scope claims.

Such rejections are respectfully traversed.

It is respectfully submitted that there is nothing inconsistent with a claim requirement that at least 98% of the chlorine scavenger is a copper compound and comprising scope claims. If a claim requirement with regard to a composition were inconsistent with comprising scope claims, then there would never be a comprising scope composition claim. Clearly if a composition includes a listed ingredient or component, then the composition necessarily includes less of other ingredients or components.

The withdrawal of this basis of rejection and notification to that effect
is requested.

The Action still further alleges that iron oxide could act as a chlorine
scavenger and thus the claim scope is alleged to be unclear "since claim 1 appears to
5 prohibit the use of other chlorine scavengers yet the dependent claims add them back
in".

Such rejections are respectfully traversed.

No evidence has been presented supporting chlorine scavenging by iron
oxide or the use of iron oxide as a chlorine scavenger. Absent such evidence,
10 the rejection has no basis and the withdrawal of such rejection is requested.

Should the Examiner subsequently present evidence supporting chlorine
scavenging by iron oxide or the use of iron oxide as a chlorine scavenger, Applicant
respectfully reserves the right to present evidence showing the ineffectiveness of iron
oxide as a chlorine scavenger, particularly at the combustion conditions (e.g.,
15 temperatures) associated with such gas generant composition combustion.

4. Claims 8-33 were rejected under 35 U.S.C. §112, second paragraph, as being
indefinite for allegedly failing to particularly point out and distinctly claim the
subject matter which applicant regards as the invention.

The Action alleges that it is unclear what a “precursor blend” is and what is the effect of this language on the claim scope.

A “precursor blend” as used in the claims and the application simply refers to a blend of specified materials/components/ingredients forming a “precursor” to the gas generating composition.

Thus, it is respectfully submitted that these claims are sufficiently definite and notification to that effect is solicited.

Claim Rejections - 35 U.S.C. §103

- 10 1. Claims 1-5, 7-13, 16-23, 25-29 and 31-33 were rejected under 35 U.S.C. §103(a) as being unpatentable over Publication No. US2003/0145921 to Blomquist et al. (hereinafter “Blomquist”).

The Action sets forth that Blomquist discloses a gas generating composition that when ignited produces a gas and fills the airbag in an airbag device. The Action further sets forth that the composition “comprises a fuel from 0-50 % such as guanidine nitrate (para. 0061), a mixture of oxidizers such as basic copper nitrate at more than 50 %, iron oxide at less than 50 % and up to 30 % of ammonium perchlorate (para. 0049-0055) all with respect to the total of the oxidizer in the composition” and that the gas generating composition is formed by mixing. While the

Action acknowledges that there is no example that uses the claimed composition with the exact amounts, the Action alleges that it would have been obvious to one having ordinary skill in the art at the time the invention was made to use the particular oxidizers "since Blomquist suggests that a mixture of three is used and also to vary the amounts of the particular ingredients of the gas generating composition to achieve a desired result."

5 The Action fails to acknowledge or appreciate that Blomquist specifically teaches:

10 The amount of conventional oxidizers in the oxidizers is limited in order to keep as low as possible the combustion temperatures and to limit the amount of difficult-to-condense residues that are produced upon combustion. [paragraph 0055].

15 Moreover, the Action fails to acknowledge or appreciate that in the examples in Blomquist wherein the gas generating material compositions contain ammonium perchlorate (AP), the gas generating materials also contain sodium nitrate.

(See Examples 14-18, in TABLE 2, page 8 and Examples 20-26, in TABLE 3, page 9.) Regarding the inclusion of such sodium nitrate, Blomquist specifically teaches that:

20 The ratio of sodium nitrate (NaN) to ammonium perchlorate (AP) in the mixture is that effective to yield upon combustion sodium chloride. (See paragraph [0101].)

It is noted that in the pending application, Applicant specifically discloses:

5 Hydrogen chloride gas can be "scavenged" or removed from the combustion gas stream by including a scavenger compound such as an alkali or alkaline earth metal nitrate such as sodium or potassium nitrate in the pyrotechnic gas generant composition. Such alkali or alkaline earth metal nitrates react with the hydrogen chloride to produce less or nontoxic alkali or alkaline earth metal chlorides such as sodium or potassium chloride. However, such alkali or alkaline earth metal chlorides may undesirably form as fine particulate matter or dust which can escape the inflator device. (See page 4, lines 8-15.)

10 Clearly, the disclosure in and teaching by Blomquist of the inclusion of sodium nitrate chlorine scavenger in the amount (e.g., "ratio of sodium nitrate (NaN) to ammonium perchlorate (AP) in the mixture is that effective to yield upon 15 combustion sodium chloride") therein disclosed clearly places Blomquist outside the scope of the pending claims which require "at least about 98 weight percent of the chlorine scavenger is a copper-containing compound". (See independent claims 1 and 21, for example.)

20 In view thereof, the withdrawal of such basis of rejection is requested and notification to that effect is solicited.

Moreover, as the only prior art grounds of rejection relative to claims 6, 15, 24 and 30 were based on Blomquist and as such prior art grounds of rejection are believed to have been shown as improper, these claims are believed to be patentable over the prior art of record and notification to that effect is solicited.

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2. Claim 14 was rejected under 35 U.S.C. §103(a) as being unpatentable over Blomquist in view of U.S. Patent 5,641,938 to Holland et al. (hereinafter "Holland").

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Holland has been cited as disclosing the use of an iron blue pigment as an additive to a gas generating composition. The Action alleges that it would have been obvious to one having ordinary skill in the art at the time the invention was made to use the iron blue pigment as taught by Holland since it is a known additive used in gas generating compositions.

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Such rejection is respectfully traversed.

Claim 14 is a dependent claim and is indirectly dependent on claim 1.

The shortcomings of Blomquist, discussed above, relative to the invention of claim 1 are not in anyway overcome or otherwise effectively addressed by the combination of Holland with Blomquist. Thus as claim 1 is believed to be patentable over the prior art of record, so too claim 14 which depends thereon is also believed to be patentable over the prior art of record and notification to that effect is solicited.

3. Claims 1-6, 8-13, 15, 17-24, 26-30, 32 and 33 were rejected under 35 U.S.C. §103(a) as being unpatentable over U.S. Patent 6,241,281 to Hinshaw et al. (hereinafter "Hinshaw").

5 The Action sets forth that Hinshaw discloses a gas generating composition for use in an airbag device which comprises 30-90 % of copper diammine dinitrate, a co-oxidizer such as ammonium perchlorate and a fuel such as guanidine nitrate. The Action further sets forth that the composition can also comprise additives such as iron oxide or silicon oxide. While the Action
10 acknowledges that there is no example that uses the claimed composition with the exact amounts, the Action alleges that it would have been obvious to one having ordinary skill in the art at the time the invention was made to use "copper diammine dinitrate with the ammonium perchlorate since Hinshaw suggests that a mixture of the two is used and also to vary the amounts of the particular ingredients of the gas
15 generating composition to achieve a desired result."

By the above, independent claim 1 has been rewritten to require that the claimed chlorine-containing gas generant composition consist essentially of:

a nitrogen-containing fuel;
ammonium perchlorate oxidizer; and

a chlorine scavenger present in an amount effective to result in a gaseous effluent that is substantially free of hydrogen chloride when the gas generant is combusted;

5. wherein at least about 98 weight percent of the chlorine scavenger is a copper-containing compound selected from the group consisting of copper nitrate complexes, basic copper nitrate, cupric oxide, and combinations thereof.

Further, independent claim 21 has been rewritten to require that the claimed chlorine-containing gas generant composition providing an improved gaseous effluent, consists essentially of:

10 about 1 to about 20 composition weight percent ammonium perchlorate oxidizer; and

about 80 to about 99 composition weight percent of a precursor blend including:

guanidine nitrate fuel; and

15 a chlorine scavenger in an amount effective to result in a gaseous effluent substantially free of hydrogen chloride,

wherein at least about 98 weight percent of the chlorine scavenger is a copper-containing compound selected from the group consisting of copper nitrate complexes, basic copper nitrate, cupric oxide, and combinations thereof.

Thus, the claimed compositions require certain specified materials in certain specified relative amounts or proportions.

It is respectfully submitted that the listings in Hinshaw of possible materials (e.g., various metals and the various complexes thereof, various binders, various co-oxidizers, various cool burning organic nitrogen compounds, etc.) are so broad as to fail to provide an appropriate teaching or suggestion to arrive at the specifically claimed compositions. For example, Hinshaw, at column 8, line 32 through column 9, line 30 identifies and provides a long list of various suitable co-oxidizers for use in the practice of the invention thereof. Moreover, Hinshaw even teaches that cobalt is the preferred metal for the metal complex used therein and proceeds to list other preferred metals as including magnesium, manganese, copper, zinc, and tin and examples of less preferred but useable metals as including nickel, titanium, chromium, rhodium, iridium, ruthenium and platinum. (See column 5, lines 61-67.)

Thus, it is respectfully submitted that the mere mention in Hinshaw of NH_4ClO_4 as a possible co-oxidizer and copper as a possible metal for the complex fails to provide a proper and necessary teaching sufficient and appropriate to render the claimed invention obvious thereover, particularly as Hinshaw appears silent with regard to chlorine being present as a result of any ammonium perchlorate and any

means for the removal or scavenging of such chlorine let alone that the compositions contain "a chlorine scavenger present in an amount effective to result in a gaseous effluent that is substantially free of hydrogen chloride when the gas generant is combusted; wherein at least about 98 weight percent of the chlorine scavenger is a copper-containing compound selected from the group consisting of copper nitrate complexes, basic copper nitrate, cupric oxide, and combinations thereof", as claimed.

Furthermore, independent claims 1 and 21 have each been rewritten to require that the copper-containing compound is selected from a specifically listed group of compounds and to use the transition language "consists essentially of", with claim 5 correspondingly being cancelled; and dependent claims 7-10, 12, 15, 16, 20, 27, 29 and 30-33 have each been rewritten to not employ "comprising" transition language.

It is respectfully submitted that Hinshaw fails to show or suggest a chlorine-containing gas generant composition consisting essentially of:

a nitrogen-containing fuel;
ammonium perchlorate oxidizer; and
a chlorine scavenger present in an amount effective to result in a gaseous effluent that is substantially free of hydrogen chloride when the gas generant is combusted;

wherein at least about 98 weight percent of the chlorine scavenger is a copper-containing compound selected from the group consisting of copper nitrate complexes, basic copper nitrate, cupric oxide, and combinations thereof, as claimed.

In view of the above, claims 1-4, 6, 8-13, 15, 17-24, 26-30, 32 and 33 are believed to be patentable over Hinshaw and notification to that effect is solicited.

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4. Claim 14 was rejected under 35 U.S.C. §103(a) as being unpatentable over Hinshaw in view of Holland.

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Holland has been cited as disclosing the use of an iron blue pigment as an additive to a gas generating composition. The Action alleges that it would have been obvious to one having ordinary skill in the art at the time the invention was made to use the iron blue pigment as taught by Holland since it is a known additive used in gas generating compositions.

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Such rejection is respectfully traversed.

Claim 14 is a dependent claim and is indirectly dependent on claim 1.

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The shortcomings of Hinshaw, discussed above, relative to the invention of claim 1 are not in anyway overcome or otherwise effectively addressed by the combination of Holland with Hinshaw. Thus as claim 1 is believed to be patentable over the prior art of record, so too claim 14 which depends thereon is also believed to be patentable over the prior art of record and notification to that effect is solicited.

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Conclusion

In view of the above, all pending claims are believed to be in condition
for allowance and notification to that effect is solicited. Should the Examiner detect
any remaining issue or have any question, however, the Examiner is kindly requested
to contact the undersigned, preferably by telephone, in an effort to expedite
examination of the application.

Respectfully submitted,



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